The Velocity of the Argentine Earthquake Pulsations of October 27, 1894.

IN several recent notes in NATURE (pp. 232, 371, 393), attention has been drawn to the great Argentine earthquake of last October 27, and to the record of its pulsations in Europe. In one of these (p. 371) a rough estimate is given of the velocity, but a more detailed one seems desirable on account of the great distance traversed by the pulsations.

According to M. Noguès (*Comptes rendus*, vol. cxx. pp. 167–170), the epicentral tract includes Rioja, San Juan and Mendoza. There is thus some uncertainty as to the exact position of the spot from which the pulsations started. In the following estimate I have supposed it to coincide with San Juan.

San Juan is about 312 km. from Santiago, and 11,600 km. from Rome, the difference being 11,288 km. The earthquake was registered by a seismograph at Santiago at 8h. 50m. 26s. p.m., Greenwich mean time. The slight preliminary pulsations were recorded by the great seismometrograph at Rome at 9h. 7m. 35s., the first maximum at 9h. 49m. 50s., and the principal maximum at 9h. 55m. 40s. Assuming that the first maximum (or beginning of the larger pulsations) corresponds to the movement which started the seismograph at Santiago, it follows that the distance of 11,288 km. was traversed by the pulsations with an average velocity of 3·17 km. per second.

It should be remarked that this estimate agrees very closely with those obtained for the same phase of the movement in the cases of the Greek earthquake of April 27, and the Constantinople earthquake of July 10, 1894 (namely, 3·21 and 3·20 km. per sec. respectively).

For the first slight movements recorded at Rome, Charkow and Nicolaiew, we must admit either that the pulsations producing them started some time before the great earthquake, or else that they travelled with a far higher velocity. If they left San Juan simultaneously with the larger pulsations (*i.e.* at 8h. 48m. 48s.), their average velocity must have been 10·38 km. per second. The horizontal pendulums at Charkow and Nicolaiew also recorded these early movements, beginning at 9h. 8m. 36s. and 9h. 12m. 6s. respectively; soon after which the curves more or less completely disappeared. San Juan is about 13,625 km. from Charkow and 13,240 km. from Nicolaiew, the average velocities to these places being therefore 11·47 and 9·47 km. per second. The latter obviously corresponds to a later phase of the movement.

Whether the slight preliminary pulsations start before, or at the moment of, the earthquake, is a question of the greatest practical importance from the point of view of earthquake-warnings. To answer it, one of the Italian seismometrographs or a horizontal or bifilar pendulum should be placed beside a seismograph in the immediate neighbourhood of the centre of disturbance.

C. DAVISON.

Birmingham, March 6.

The Society of Spelæology.

THE attention of your readers has already been called to the formation of this Society in Paris (NATURE, January 3), the promotion of which is due to the action and enthusiasm of M. E. A. Martel, the author of the beautifully-illustrated work "Les Abîmes," reviewed by Prof. Bonney in your pages of the 28th ult. This book describes and illustrates a number of extraordinary and often hazardous subterranean explorations in the underground caves and watercourses of the limestone districts of France, Belgium, Austria, and Greece. The Society is intended to carry on the work thus initiated by M. Martel and his devoted co workers in a more effective manner, and over a wider area than has been possible by private enterprise. The formation of the Society, M. Martel writes me, is now an accomplished fact. About 130 gentlemen of all nationalities, some of whom bear well-known names in the ranks of science, have signified their adhesion. A provisional code of rules has been printed and adopted, and a meeting has already taken place, under the presidency of the president-elect, M. F. Deloncle, Deputy for the Basses-Alpes.

The first article of the rules states the object of the Society as follows:—"The Society of Spelæology is instituted in order to ensure the exploration—to facilitate the general study—to cooperate in the regulation or ultilisation—of subterranean cavities of all sorts, known or unknown, whether natural or artificial; to encourage and aid with funds investigations relating thereto; in a word to popularise and develop in a way, at once practical and theoretical, utilitarian and scientific, researches of all kinds in the interior of the earth." The subscription for ordinary members is fifteen francs per annum. It is intended to publish a quarterly bulletin; to a copy of which each member will be entitled.

In order to fully carry out the objects of the Society, the programme of which is a comprehensive one, more members are required, and I shall be glad to furnish any of your readers who may wish to join the society with the proposal form or *Bulletin d'Adhésion*, or they may be obtained from M. Martel, General Secretary, 8 Rue Ménars, Paris.

M. Martel, I may say, is desirous of extending his investigations to the British Isles, if sufficient inducement be offered in the exploration of some large cave, as yet unworked or imperfectly known, and where his apparatus of rope ladders, collapsible boats, &c., would be useful aids. Information on this head will be thankfully received by me. MARK STIRRUP.

Bowdon, near Manchester, March 6.

Contraction of Trees caused by Cold.

THE splitting of forest trees by frost is often ascribed to the same cause which bursts a pipe charged with water when the temperature falls below 32° F., namely, the expansion of the water on turning into ice. Botanists know that this is not so, but the splitting is owing to a contraction of the wood by frost, similar, but in a less degree, to what happens when the wood is dried. With the thaw the trees expand to their original dimensions. Evidence of such contractions and expansions is furnished by the measurements herewith.

For some years past, I have regularly taken the girths of a number of forest trees during summer, in order to note the amount of growth. To do this accurately I have to use a steel tape, and of course to girth the trees at exactly the same place. My experience, thus acquired in measuring to a nicety, is a sufficient reason for confidence that the following figures are substantially correct.

Girth of trees in October 1894, when done growing and before the frost.			Girths, February 8, 1895, 9 a.m. Temp. 3° F.	Girths, March 2, 1895, 3 p.m. Temp. 39° F.	Amount of contraction with frost.
No.		Inch.	Inch.	Inch.	Inch.
1	Sycamore	...$26\frac{3}{4}$	$26\frac{5}{8}$	$26\frac{3}{4}$	$\frac{2}{16}$
2	Sycamore	...$22\frac{1}{2}$	$22\frac{3}{8}$	$22\frac{1}{2}$	$\frac{2}{16}$
3	Sycamore	...33	$32\frac{13}{16}$	33	$\frac{3}{16}$
4	Elm ...	...$28\frac{7}{16}$	$28\frac{1}{8}$	$28\frac{7}{16}$	$\frac{5}{16}$
5	Elm ...	...22	$21\frac{3}{4}$	22	$\frac{4}{16}$
6	Elm ...	...$19\frac{9}{16}$	$19\frac{3}{8}$	$19\frac{9}{16}$	$\frac{3}{16}$
7	Ash ...	...$46\frac{3}{16}$	$45\frac{13}{16}$	$46\frac{3}{16}$	$\frac{6}{16}$
8	Oak ...	...$42\frac{1}{2}$	$42\frac{3}{16}$	$42\frac{1}{2}$	$\frac{5}{16}$
9	Oak ...	...$17\frac{9}{16}$	$17\frac{1}{4}$	$17\frac{9}{16}$	$\frac{5}{16}$
10	Oak ...	...$35\frac{3}{16}$	$34\frac{13}{16}$	$35\frac{3}{16}$	$\frac{6}{16}$
11	Beech	...$21\frac{1}{2}$	$21\frac{5}{16}$	$21\frac{1}{2}$	$\frac{3}{16}$
12	Beech	...$32\frac{3}{4}$	$32\frac{7}{16}$	$32\frac{3}{4}$	$\frac{5}{16}$
13	Beech	...$42\frac{1}{8}$	$41\frac{7}{8}$	$42\frac{1}{8}$	$\frac{4}{16}$

Bradford, March 4. J. CLAYTON.

The Barrenness of Precambrian Rocks.

REFERRING to the paragraph in NATURE (February 28, p. 423), on the sudden appearance of a rich fauna in the Lower Cambrian rocks, I should like to make a suggestion for the consideration of geologists. May not the extreme poverty of organic remains in Precambrian (Archæan) strata be largely due to a scarcity of carbonate of lime in the water of the Precambrian seas? The Uriconian and Longmyndian rocks of Shropshire, which, at the very least, must include five miles of sediment, comprise hardly a scrap of limestone. The same remark will apply to the Precambrian strata of Charnwood, South Wales, the mainland of North Wales, and the great Torridonian group of Scotland. The Pebidian rocks of Anglesey contain bands of limestone, it is true, but it is highly probable that they are of chemical origin, and not derived from oceanic waters. There are, of course, plenty of limestones in the older Archæan rocks of North America, and a few of them in the Lower Archæans of

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Britain; but the proof of their marine origin remains to be written. They contain no undisputed organic remains. The rocks in which they are intercalated are not proved to be altered sedimentaries. There were numerous animals living in the Salopian area in the Longmyndian epoch, for their trails are quite abundant in some of the slaty seams; but, if there were no carbonate of lime in the sea, there could, of course, be little material to provide shells for its inhabitants. Numerous creatures of many types might have been evolved, whose soft tissue would leave no traces in the rocks. In succeeding ages, as the forces of denudation cleared off the newer Archæan, and cut down into partially decomposed crystallines, abundance of calcic carbonate would be carried down into the sea. C. CALLAWAY.

Wellington, Shropshire, March 1.

The Artificial Spectrum Top.

IN your issue of March 7, we notice a letter from Dr. Dawson Turner, in which he says he has had a "Benham's Spectrum Top" made on glass, by an optician, for the lantern, and recommending others to do the same.

Will you allow us to state that we have sold all rights in this copyright top to Messrs. Pears, reserving to ourselves only the sole right of making them as lantern slides, in which form we have been supplying them for some time.

The tops can be obtained from Messrs. Pears, and the lantern slides from us; any one else supplying either will, of course, be infringing the copyright. NEWTON AND CO.

RESEARCH IN EDUCATION.[1]

NO branch of *research work* at the present day offers greater opportunities, whilst none is more urgently in need of *original* workers, than that which lies open to the teacher in school or college; and it is surprising how small an amount of sound work is accomplished in it—how little it is realised that there is a science of education to be developed by persistent study, application and research. An analytical habit of mind seems to be the very last qualification sought for in a teacher—such is the influence acquired by clerical instructors in the course of centuries by the universal extension of methods of teaching originated in the monkish cell and cloisters, and wielded with but slightly diminished force, even to-day, by their lineal descendants, whose voices still preponderate in educational affairs. Conservative and sheep-like—as we cannot fail to be if all our early life be spent in an atmosphere of dogmatism—the slowness with which we evolve and apply new ideas is phenomenal. It cannot be that sterility is the outcome of excessive labour in days gone by, and consequent exhaustion of the soil; still less, that it is owing to absence of demand; for it is only too clear that the entire change in the conditions of life witnessed within the century renders it necessary that our children should be so educated that they may successfully grapple with the new conditions, and it stands to reason that the preparation which sufficed in the case of their forefathers must be insufficient in theirs. This is now being universally recognised, but all too slowly and imperfectly. Thus the academic oration first on my list, delivered only in September last, at Freiburg, by the Professor of Anatomy, is a vigorous protest against the practice prevailing in the German "Humanistic" Gymnasia of devoting an enormous proportion of the school-time to classical studies, and the consequent neglect of drawing, natural science, geography and modern languages, as well as of gymnastic exercises, which is very strange, as he points out, when it is remembered that the meaning of *gymnasium* is a place for athletic pursuits. He especially complains of the way in which exercises in classical style are insisted on and monopolise attention, and strenuously advocates their banishment from the three lowest classes at least. He refers with feeling to the pressure which is brought to bear in school and at home on the child to whom such work does not appeal, and the unhappy state of house and family on "style-days," remarking that every one who, like himself, has had this experience in his own person and that of his children, will sympathise with this view. He tells us that his own bitter experience of thirty-five years ago still follows him in his dreams, and that he can never forget the encouraging words hurled at him by the master of the "Prima" of the Stuttgart Gymnasium when he had done a bad Latin exercise—"You never in your life will come to any good, as sure as my name is Schmid." Is not this too often the attitude of our schoolmasters, and is it not too often forgotten that the human mind, fortunately, will not in all cases respond to one uniform system of treatment? Surely the time must soon come when it will be the main duty of headmaster and headmistress to study their scholars, and assort them in accordance with their aptitudes; when no headmaster will set down a boy as of inferior intellect merely because he does not get on well on the classical side, and cannot therefore be made use of with effect as the winner of a scholarship at the university—a course which some of our most noted headmasters appear too often to countenance if report belie them not. Fortunately we are not here so much the victims of educational overpressure as is Germany under the terrible influence of its military system, although there is enough to complain of, especially in the case of girls' schools, owing to the improperly large number of subjects included in the time-table; moreover, examinations, such as the London University Matriculation, are exercising a most insidious effect: and now that County Councils all over the country are granting scholarships on the results of examinations, it behoves us to be much on our guard, and to take steps to secure that all such examinations are so conducted that reasonably well-taught and reasonably intelligent scholars can be submitted to them without any interference with the normal school course. Prof. Wiedersheim, referring to the very one-sided training given in the Gymnasia to the future jurist, theologian and philologist, calls attention to the importance to such students of some knowledge of natural science in the following passage, which undoubtedly deserves our attention, as we suffer in like manner: "Kein Gebildeter vermag sich heutzutage dem Einflusse, welchen die Naturwissenschaften auf das Geistesleben aller Culturnationen gewonnen haben, mehr zu entziehen. Die ganze moderne Weltansschauung, unser Leben und Denken, die Forschung auf allen Gebieten—ich erinnere nur an das auch in der vergleichenden Linguistik zur Geltung kommende genetische und causale Element—stehen unter der Signatur der inductiven Forschung. Mit diesem Umschwung hat auch das humanistische Gymnasium zu rechnen, sollen nicht Juristen, Philologen und Theologen in ihrem ganzen Bildungsgang einen Fehler aufweisen, der oft nicht mehr gut zu machen ist." But this is nowhere properly recognised. And yet Charles Kingsley long ago dreamt of a day when every candidate for ordination should be required to have passed creditably in at least one branch of physical science—*if only to teach him the method of sound scientific thought*. Dr. Percival

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[1] "Ueber die Vorbildung unserer akademischen Jugend an den humanistischen Gymnasien."—Programm wodurch zur Feier des Geburtsfestes seiner königlichen Hoheit unseres durchlauchtigsten Grossherzogs Friedrich im Namen des academischen Senats die angehörigen der Albert-Ludwigs Universität einladet der gegenwärtige Prorector Dr. Robert Wiedersheim. (Freiburg, 1894.)

"The Teacher's Manual of Lessons on Elementary Science." By H. Major, B.A., B.Sc., Inspector of Board Schools, Leicester. (Blackie and Son.)

"Practical Lessons in Physical Measurement." By Alfred Earl, M.A., Senior Science Master at Tonbridge School. (Macmillan and Co.)

"A Laboratory Manual of Physics and Applied Electricity." Arranged and edited by Edward L. Nichols, Professor of Physics in Cornell University. Vol I. Junior Course in General Physics, by Ernest Merritt and Frederick J. Rogers. Vol. II. Senior Courses and Outlines of Advanced Work, by G. I. Moler, F. Bedall, H. J. Hotckiss, C. P. Matthews, and the Editor. (New York and London: Macmillan and Co.)

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